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REMARKS***Claim Rejections - 35 USC § 103***

Examiner rejects Claims 1,3,9,11,13,15,17 under 35 U.S.C. 103(a) as being unpatentable over Young et al. in view of Denov et al.

Specifically, examiner states that "Young et al. . . . discloses all features claimed, but does not explicitly disclose exclusive-OR comparing. Denov et al. disclose a tuning device similar to applicants' invention, which comprises exclusive-OR gates 146,170 for signal comparison. It would have been obvious to adapt the Young teachings with those of Denov, as exclusive-OR comparing is functionally equivalent to the signal comparing utilized by Young." (emphasis added) This rejection cannot be sustained, for several reasons.

First, the exclusive-OR (XOR) gates **146** and **170** used in Denov generate a pulse each time the square wave output signal from divide circuit **140** either rises or falls. These exclusive-OR gates have *nothing whatsoever* to do with the vibration sensing or signal comparison taking place in Denov's vibration sensor **16** (column 12, lines 30-68), and they are *not* "functionally equivalent to the signal comparing utilized by Young." Secondly, Denov's vibration sensor **16** makes no use whatsoever of any exclusive-OR gating but rather makes use of a "pair of photoresistors **30** and **32**" which "form two arms of a conventional bridge circuit" (column 4, lines 11 and 18-19). Third, given the fact that Denov is expressly aware of and cleverly employs exclusive-OR gates elsewhere in his system for rise/fall

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detection but does not employ exclusive-OR gates for vibration sensing even though this would be possible based on applicants' novel and nonobvious disclosure, *Denov* is in fact teaching away from using exclusive-OR comparison for vibration sensing.

5        The upshot is that examiner has found exclusive-OR gates used somewhere in *Denov*'s system though not used for vibration sensing, has also found also vibration sensors in both *Denov* and *Young* neither of which use exclusive-OR gates, and has concluded that the existence of exclusive-OR gates somewhere in *Denov* -  
10      although totally unrelated to the vibration sensing - renders it obvious to employ exclusive-OR comparison as a functional equivalent of *Young*'s 8751 Single-Chip Microcomputer. This conclusion is reached without the slightest hint or suggestion anywhere in *Young* or *Denov* that an exclusive-OR comparison might  
15      be employed for vibration sensing itself, and without any teaching whatsoever about how to use an exclusive-OR comparison for vibration sensing even if one were inclined to do so in the first place.

      In sum, examiner erroneously holds, because *Young* and *Denov*  
20      do vibration sensing by means other than exclusive-OR comparing, and because *Denov* uses exclusive-OR gates elsewhere in a part of his system unrelated to vibration sensing, that 1) it would be obvious to use an exclusive-OR gate for vibration sensing itself and 2) it would be obvious how to use this exclusive-OR gate for  
25      vibration sensing. There is no teaching in the art of record to support this.

      We now examine this in further detail. First, we will

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review the pertinent features of applicants' disclosure as set forth in claim 1; then we will examine what Denov actually teaches in relation to applicants' claim 1.

Applicants' claim 1 recites, in pertinent part, "generating 5 a comparison signal (214) by exclusive-OR comparing (210) a reflected signal (202) . . . with a reference signal (206) . . . ; and extracting a representation signal (216) by passing through from said comparison signal (214), frequencies lower than a low pass threshold (212)."

10 As set forth clearly by applicants' disclosure particularly in Figure 5 and the associated discussion of paragraphs 26 and 27, the exclusive-OR comparison of reflected signal **202** with reference signal **206** results in a comparison signal **214** in which the highs last longer than the lows while the drumhead is toward 15 the "+" peak of its movement, and in which the lows last longer than the highs while the drumhead is toward the "-" valley of its movement. Thus, upon "passing through from said comparison signal (214), frequencies lower than a low pass threshold (212)," the representation signal **216**, which effectively averages the 20 highs and lows from comparison signal **214**, provides a direct representation of the actual motion of the drumhead, thus sensing the vibration. This is a novel and nonobvious method of using exclusive-OR comparison in combination with low pass filtering to detect surface vibration which is not disclosed, suggested, or 25 motivated by Young or Denov, separately or in combination.

The function of Denov's exclusive-OR gates **146** and **170** is spelled out clearly in column 12, lines 30-68: "Divide circuit

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140, in the present embodiment . . . produces a square wave having the same amplitude as the square wave received from operational amplifier 134, but having a period twice as long. . . . The square wave produced by divide circuit 140 is then fed 5 through resistor 142 to input terminal 148 of exclusive-OR gate 146. . . . [E]xclusive OR gate 146 will only produce a logic 1 in the form of a pulse responsive to the leading and trailing sides of the square wave which it receives. Exclusive OR gate 146 produces a latch pulse; and the latch pulse is timed to occur at 10 each signal cycle received by divide circuit 140. Likewise, exclusive-OR gate 170 functions in a similar fashion to produce a reset pulse [which] will be produced on the order of one microsecond after the latch pulse."

Referring to Denov's Figure 6, Figure 1 below illustrates in 15 detail, the signal processing which is described above. A square wave which is input to divide circuit 140 emerges from divide circuit 140 with its amplitude unchanged, but with a "period twice as long." This signal from divide circuit 140 is then fed directly into a first input terminal 150 of exclusive-OR gate 20 146, and via RC integrating circuit 142, 144 into a second input terminal 148 of exclusive-OR gate 146. This signal from divide circuit 140 is also fed via RC integrating circuit 162, 164 into a first input terminal 172 of exclusive-OR gate 170, and via RC integrating circuit 166, 168 into a second input terminal 174 of 25 exclusive-OR gate 170.

As stated by Denov at column 12, lines 56-68, "[t]he value of capacitances 144, 164 and 168 is, respectively, 0.001

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microfarad, 0.0022 microfarad and 0.0033 microfarad. It is apparent that the time constants of resistance-capacitance pair **142** and **144**, resistance-capacitance pair **162** and **164**, and resistor **166** and capacitor **168**, are different. Since the time constants of the RC circuits connected to input terminals **172** and **174**, respectively are different and gate **170** is an exclusive-OR gate, a reset pulse will be produced on the order of one microsecond after the latch pulse." Also, because of these varying RC circuits, though not explicitly stated, the pulse widths themselves will be on the order of 1 microsecond.

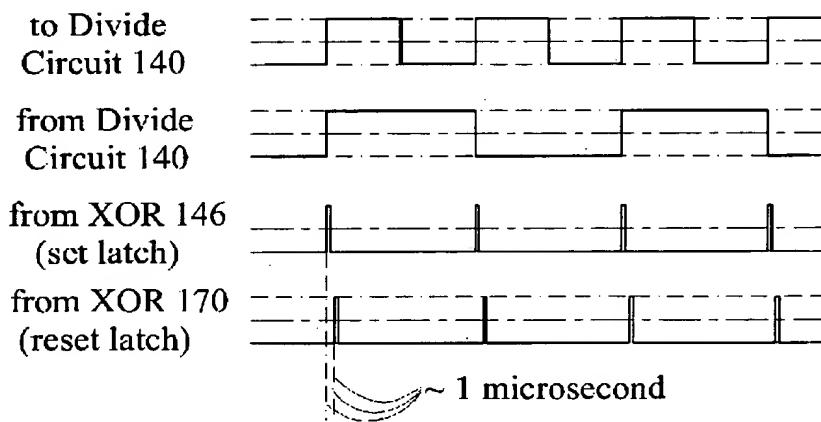


Figure 1

In sum, because each respective capacitor **144**, **164** and **168** 15 steps up by approximately .001 microfarad, the delay introduced by RC integrating circuit **142**, **144** relative to the direct feed into terminal **150** produces a pulse from XOR 146 (set latch) with an approximately one microsecond width and with a leading edge coinciding with the leading edge of the pulse to divide circuit

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140. The even longer delays introduced by RC integrating circuit **162, 164** and RC integrating circuit **166, 168** produce a similar pulse from XOR 170 (reset latch), the leading edge of which is delayed from the trailing edge of the earlier pulse by 5 approximately 1 microsecond. These two pulses emerging from the exclusive-OR gates are used to set and reset the latch, in synchronization with the leading edge of the original pulse to divide circuit 140. Again, this is all illustrated in Figure 1 above.

10 Contrasting this with applicants' Figure 5, it is clear that Denov's use of exclusive-OR gating serves a very different function than that of applicants. Denov uses the combination of divide circuit **140** and two exclusive-OR gates **146, 170** fed by variable capacitance RC circuits to produce set and reset pulses 15 synchronized with square wave pulse input to divide circuit **140**. Applicants use the combination of a single exclusive-OR comparison feeding to low pass filtration to produce a complete representation of the actual analog vibration of surface **13** and thereby sense vibration.

20 Having established that Denov's exclusive-OR gates are not used to sense vibrations and provide no suggestion or motivation whatsoever in that direction, we now turn to how Denov actually does sense vibration.

As set forth in Denov at column 11, lines 28-41 and 25 illustrated in the upper left corner of Figure 5, "[o]ptical vibration sensor **16** . . is comprised of two photoresistors **30** and **32**, which are connected in a Wheatstone bridge circuit **40**.

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Optical vibration sensor **16**, of which Wheatstone bridge circuit **40** is a part, produces a signal in response to the vibrations of drumhead **12**. The bridge signal is received by low-pass filter **54**. Low-pass filter **54** suppresses the signal harmonics or 5 overtones relative to the fundamental. The filter removes signal harmonics over a one-octave range in order to prevent overtones from actuating motor **288** and detuning the kettledrum inadvertently. The ratio between a given fundamental and its overtone is held constant over the one octave range by low-pass 10 filter **54**."

In short, Denov detects the drumhead vibrations with an optical circuit (note that applicants use an ultrasonic signal) in which the photoresistors **30** and **32** "form two arms of a conventional bridge circuit **40**" (column 4, lines 18-19). This 15 does not in any way disclose or suggest applicants' combination of exclusive-OR comparing followed by low-pass filtering. Moreover, whereas applicants' low-pass filtering is used to average out the exclusive-OR comparison signal **214** to produce a direct representation of the actual surface vibration, Denov's 20 low pass filter "removes signal harmonics over a one-octave range in order to prevent overtones from actuating motor **288** and detuning the kettledrum inadvertently." This is a totally different purpose which does not in any way disclose or suggest 25 or motivate applicants' claimed method of sensing vibration using low pass filtering to average the output of an exclusive-OR comparison.

Because Denov's use of exclusive-OR logic to produce set /

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reset pulses does not in any way disclose, suggest or motivate using exclusive-OR comparison in combination with low pass filtering to sense surface vibration or *how to do so*; because Denov's use of two photoresistors in a bridge circuit to sense 5 drumhead vibration also does not in any way disclose, suggest or motivate using exclusive-OR comparison in combination with low pass filtering to sense surface vibration or *how to do so*; because Denov's use of a low pass filter to "suppresses the signal harmonics or overtones relative to the fundamental" does 10 not in any way disclose, suggest or motivate using low pass filtration for averaging the output of an exclusive-OR comparison and thereby representing actual surface vibration; and because Young also does not disclose, suggest, or motivate any of the foregoing, separately or in combination with Denov; the 35 USC 15 103 rejection cannot be sustained.

**Conclusion**

Claims 19-68 have already been allowed. As a consequence of the foregoing, applicants respectfully request allowance of claim 20 1 and all claims dependent thereon, and look forward to receiving a notice of allowance in the near future.

Respectfully submitted,



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